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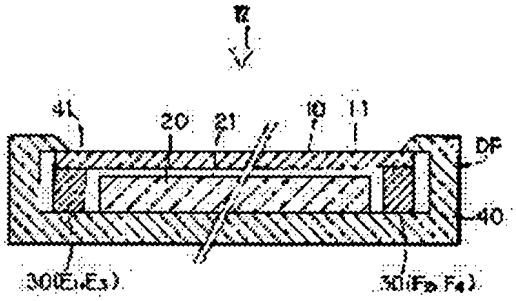
(54) INFORMATION DISPLAY DEVICE AND OPERATION INPUT DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an information display device capable of giving a sure operation feeling without a push-in stroke, performing a tracing operation and reducing the number of parts around an operation surface and a display surface.

SOLUTION: An operation panel 10 is arranged on a liquid crystal display panel 20 and the operation panel 10 is supported by piezoelectric elements E1-E4. When the operation surface 11 of the operation panel 10 is pressurized with a finger, a voltage is generated at both ends of the piezoelectric elements E1-E4 by that, and by detecting it and performing an arithmetic operation, operation force and an operation position are detected. When the operation force larger than a prescribed threshold value is detected, a high frequency is supplied to the piezoelectric elements E1-E4 and thus, the operation surface 11 is vibrated. An operator obtains the sure operation feeling by the vibration. Since the operation force to the operation surface is detected and the vibration is imparted to the operation surface 11 by the common piezoelectric elements E1-E4, the number of the parts is reduced. Also, since the panel is not reacted with the operation force smaller than the prescribed threshold value, the tracing operation is possible.



* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the information display and actuation input unit which are used for for example, FA (factory automation) device, an automatic vending machine, an automatic ticket vending machine, a cash automatic accounts machine, an electrical home appliance, the actuation device of medical application, information machines and equipment, a Personal Digital Assistant, a game machine, etc.
[0002]
[Description of the Prior Art] As one of the information displays which has an actuation input function, what has arranged the touch panel is widely used on the display. It has the advantage that a touch panel is a thin shape very much, and its degree of freedom of selection of the field which can be used as a switch is high.
[0003] Since the pushing stroke is zero mostly, the place but on the other hand the touch panel lack in the feel (feeling of actuation) of having performed the actuation input, and they have insecurity about whether the actuation input was actually received by the equipment side also as an operator in many cases.
[0004] Corresponding to such a situation, when an actuation input is actually received, the foreground color of an actuation part is changed or a device which produces the acoustic-sense-reaction of generating a visual reaction, such as carrying out a flash plate, and an audible tone is also made.
[0005]
[Problem(s) to be Solved by the Invention] It carries out, and though nothing, with the equipment using a visual reaction, there is a problem that hide in an operator's finger and change of a foreground color becomes hard to see. Moreover, when change of a foreground color is delicate, recognition is difficult for visually impaired persons, such as dysopsia.
[0006] Moreover, it may be indistinguishable in the equipment using an acoustic-sense-reaction from the surrounding noise, and may fail to hear an audible tone with it. Although an audible tone can also be enlarged for preventing this, if it is made such, it will not be clear anymore the audible tone from which automatic ticket vending machine it is in a location which has arranged two or more automatic ticket vending machines, for example. Furthermore, it will become a surrounding trouble, if an audible tone is made excessive case [like a cellular phone]. Moreover, a hearing-impaired person cannot catch the reaction by the audible tone.
[0007] Although the above explained the case of the equipment which used the touch panel, these technical problems are technical problems common to an information display in which not only the information display that used the touch panel but a control unit does not have a substantial pushing stroke.
[0008]
[Objects of the Invention] It sets it as the 1st purpose that this invention offers the information display which can give a positive feeling of actuation even if it is made in order to solve the trouble of the above

conventional techniques, and a control unit does not have a substantial pushing stroke.
[0009] The 2nd purpose of this invention is realizing the simple information display which decreased the components mark of a near [the screen or an actuation side].
[0010] Moreover, the 3rd purpose of this invention is permitting the operating instructions (it being traced and operated) made to arrive at the target actuation field, sliding a finger on the display screen, and making it such a reaction that the equipment side mistook until it traced and actually performed press actuation in the target actuation field in actuation not shown.
[0011] Furthermore, the 4th purpose of this invention is having changed the reaction from an equipment side with the locations and operating physical forces which performed press actuation, and making a feeling of actuation variegated by it.
[0012] Furthermore, the 5th purpose of this invention is offering the equipment which extended the area of the screen or an actuation side.
[0013] Moreover, it is also setting to one of the purposes of this invention to offer the actuation input unit using the principle which realizes the above information displays.
[0014]
[The basal principle of invention] Corresponding to the 1st above-mentioned purpose, dynamic reactions, such as vibration of an actuation side and very small displacement, are used as a response from the equipment side to an actuation input by this invention. For example, by using a piezoelectric device (namely, a piezoelectric transducer or a piezo-electric element) etc., an actuation side is vibrated and a positive feeling of actuation can be given to an operator by it.
[0015] By the way, it is required to detect the actuation input to an actuation side as a fundamental request of an information display which has an actuation input function. Therefore, in the equipment constituted so that an actuation side might be made to produce dynamic reactions, such as vibration, the both sides of the function which detects an actuation input, and the function which generates a dynamic reaction must be given.
[0016] In here, as for the artificer of this invention, a piezoelectric device etc. pays its attention to a dynamic operation and an electrical signal that it is a functional means (the following, "bidirectional functional means") convertible in both directions. That is, in such a bidirectional functional means, if an electrical signal is impressed, while producing dynamic reactions, such as vibration, if thrust is applied to this bidirectional functional means, electric reactions, such as an electrical potential difference, will be produced.
[0017] Then, it is the basic principle of this invention to realize an actuation detection function and a dynamic reaction generating function in combination with one bidirectional functional means (or 1 set), using the property of such a bidirectional functional means positively.
[0018] In ******** and this invention, detection of an actuation input is performed among many functions of a bidirectional functional means by "the conversion function from a dynamic pressure to an electrical potential difference (or current)", and the dynamic reaction to an actuation side is produced by "the conversion function to the dynamic reaction from an electrical potential difference (or current)."
[0019] A positive feeling of actuation can be given by this, without increasing components mark.
[0020]
[The concrete configuration for solving a technical problem] The information display of invention of claim 1 constituted according to the above-mentioned principle (a) The transparence or the translucent control unit which has an information-display side and a (b) predetermined actuation side, and has been arranged on said information-display side, (c) It combines with said control unit. A dynamic operation and an electrical signal A bidirectional functional means convertible in both directions, (d) It has the actuation signal drawing means which takes out the electrical signal generated from said bidirectional functional means according to the operating physical force given to said actuation side as an actuation signal, and the drive control means which answers the (e) aforementioned actuation signal and sends out an electric driving signal to said bidirectional functional means.
[0021] And by said driving signal, the dynamic reaction produced with said bidirectional functional means is transmitted to said actuation side, and is realized as an operator's tactile feeling.

[0022] In invention of claim 2, in the information display of claim 1, said drive control means compares said (e-1) actuation signal with a predetermined threshold, and when said actuation signal exceeds said threshold, it has an actuation signal judging means to send out said driving signal to said bidirectional functional means.
[0023] In invention of claim 3, said actuation signal judging means is characterized by changing the mode of said driving signal according to the magnitude of said actuation signal in the information display of claim 2.
[0024] In invention of claim 4, it sets to the information display of either claim 1 thru/or claim 3. Said bidirectional functional means (c-1) Are separated and arranged mutually spatially, and while having two or more unit functional means convertible in both directions, each a dynamic operation and an electrical signal Said information display is (f) further. It has a position signal generating means to generate the position signal which expressed the actuated valve position on said actuation side based on two or more electrical signals generated from said two or more unit functional means according to the operating physical force given to said control unit.
[0025] In invention of claim 5, it has three or more unit functional means distributed two-dimensional as said two or more unit functional means in the information display of claim 4.
[0026] In invention of claim 6, in the information display of claim 5, said actuation side is an abbreviation rectangle side, and has four unit functional means arranged in about 4 corners of said abbreviation rectangle side as said two or more unit functional means.
[0027] Invention of claim 7 is the information display of either claim 1 thru/or claim 3, and is said actuation means. (b-1) It has the touch panel which generates the position signal according to the actuated valve position on said actuation side.
[0028] Invention of claim 8 is the information display of either claim 4 thru/or claim 7, and said drive control means changes said threshold about said actuation signal according to said position signal.
[0029] Invention of claim 9 is the information display of either claim 4 thru/or claim 7, and said drive control means changes the mode of said driving signal according to said position signal.
[0030] Invention of claim 10 is the information display of either claim 2 thru/or claim 9, and when the (g) aforementioned actuation signal exceeds said threshold, it is further equipped with a logic-gate means to transmit generating of said position signal to a predetermined information processing means.
[0031] Invention of claim 11 is the information display of either claim 1 thru/or claim 10, and said bidirectional functional means contains a piezoelectric device.
[0032] In invention of claim 12, it holds in portable housing which has a predetermined principal plane, and the information display of either claim 1 by which the actuation side was exposed to said principal plane, and was used as the portable mold thru/or claim 10 is offered.
[0033] Invention of claim 13 is the information display of claim 12, is arranged fixed and equips further fields other than said principal plane of said housing with 1 which receives the actuation according to the contents of a display of said screen, or two or more actuation switches.
[0034] Invention of claim 14 is constituted among invention of claim 1 - claim 13 paying attention to pinpointing of the actuated valve position by detection of thrust.
[0035] Namely, the information display of invention of this claim 14 (a) The transparence or the translucent control unit which has an information-display side and a (b) predetermined actuation side, and has been arranged on said information-display side, (c) Distribution arrangement is spatially carried out within limits combined with said control unit. Each a dynamic operation Two or more unit functional means convertible into an electrical signal, (d) The actuation signal drawing means which takes out the electrical signal generated from said two or more unit functional means according to the operating physical force given to said actuation side as two or more actuation signals, (e) Based on said two or more actuation signals, it has a position signal generating means to generate the position signal expressing the actuated valve position on said actuation side.
[0036] Moreover, invention of claim 15 is constituted paying attention to detection of thrust, and the part of the dynamic reaction by it, without asking the existence of the screen among invention of claim 1 - claim 13.

[0037] Namely, the actuation input unit of invention of claim 15 (a) It combines with the control unit which has a predetermined actuation side, and the (b) aforementioned control unit. A dynamic operation and an electrical signal A bidirectional functional means convertible in both directions, (c) It has the actuation signal drawing means which takes out the electrical signal generated from said bidirectional functional means by the thrust given to said actuation side as an actuation signal, and the drive control means which answers the (d) aforementioned actuation signal and sends out a driving signal to said bidirectional functional means.
[0038] And the dynamic reaction of said bidirectional functional means by said driving signal is transmitted to said actuation side, and is realized as an operator's tactile feeling.
[0039] Moreover, invention of claim 16 adds the configuration of invention of claim 14 to invention of claim 15. Distribution arrangement of said bidirectional functional means was specifically spatially carried out within limits combined with said (b-1) control unit, and each is equipped with two or more unit functional means convertible into an electrical signal for the dynamic operation. and said actuation signal -- said two or more unit functional means -- respectively -- since -- while being obtained as two or more unit-operation signals generated -- (e) -- it is the actuation input unit further equipped with a position signal generating means to generate the position signal expressing the actuated valve position on said actuation side based on said two or more unit-operation signals.
[0040]
[Embodiment of the Invention] <1. 1st operation gestalt ><1-1. Outline > drawing 1 of equipment is the perspective view of the cash automatic accounts machine (ATM) 1 as an example of a system incorporating the information display 100 of the 1st operation gestalt of this invention. This cash automatic accounts machine 1 equips the front face of a case 2 with the cash accounts section 3, and a card and the passbook insertion section 4. Moreover, the information I/O section 5 is arranged and the information display 100 is used for this information I/O section 5.
[0041] Drawing 2 is the external view of an information display 100. Although an information display 100 turns a principal plane to the abbreviation upper part and is arranged in the example of use shown by drawing 1 , this information display 100 is stood and illustrated in drawing 2 .
[0042] In drawing 2 , this information display 100 is equipped with the abbreviation box-like housing 101, and the part held in this housing 101 is divided roughly into the display control unit DP which faced the operator side, and the control circuit section CT on that background.
[0043] The actuation side 11 of an abbreviation rectangle is exposed to the principal plane MS of housing 101. This actuation side 11 is transparent or translucent, and can view the contents of a display of the information-display side 21 (refer to drawing 3) through the actuation side 11. Moreover, the pushbutton switch 102 of immobilization can also be arranged on a principal plane MS.
[0044] drawing 3 shows the part which is equivalent to the display control unit DP among the III-III cross sections of drawing 2 -- it is an abbreviation sectional view a part. Moreover, drawing 4 is the fluoroscopy top view seen from [of drawing 3] IV. In drawing 3 , this display control unit DP has held the liquid crystal display panel 20 in the case 40 where it has an aperture 41, and the principal plane of this liquid crystal display panel 20 is the information-display side 21.
[0045] As shown in drawing 4 , the four corners of the liquid crystal display panel 20 are adjoined, respectively, and four piezoelectric devices E1-E4 are arranged. Piezoelectric devices E1-E4 are the unit functional means as an element of the bidirectional functional means 30 convertible in both directions about a dynamic operation and an electrical signal. These piezoelectric devices E1-E4 are being fixed to the base of the case 40 of drawing 3 , and transparence or near the four corners of the translucent control panel 10 are supported by those crownings. This control panel 10 is a glass plate, an acrylic board, etc., and has the flat-surface configuration of an abbreviation rectangle.
[0046] Although various information can be displayed on the liquid crystal display panel 20 adjustable, in the example of drawing 4 , the menu of automatic cash accounts of a bank is displayed. The fields R1-R7 where these menus were displayed are also the actuation fields by the person for silver Yukitoshi. For example, if the person for silver Yukitoshi presses with a finger the field R1 top where "making a deposit" was displayed by the force more than predetermined, while this information display 100 will

detect that "making a deposit" was chosen by actuation mentioned later and notifying that to the host computer of a bank, it will be in the condition that cash can be received. Moreover, synchronizing with it, the display in this information-display side 21 changes to the screen where the guidance for acceptance of cash and a new actuation menu were displayed. In addition, the magnitude and the location of these actuation fields R1-R7 can be set as arbitration. Moreover, the field R0 in drawing 4 shows the field which is not the actuation fields R1-R7 among the information-display sides 21.
[0047] And with the equipment of this 1st operation gestalt, the piezoelectric devices E1-E4 of drawing 3 are used as an element which served as the both sides of the detection means for detecting any of the actuation fields R1-R7 the person for silver Yukitoshi pressed, and the driving means for vibrating a control panel 10 finely according to that press.
[0048] <1-2. detection principle [of an actuated valve position] > -- before explaining the configuration of the remainder in this equipment, the principle which detects any of the actuation fields R1-R7 were pressed using piezoelectric devices E1-E4 is explained.
[0049] Drawing 5 is a model Fig. for explaining this principle, and drawing 5 (a) indicates n piezoelectric devices E1-En made to arrange along near [that] a periphery to be control-panel 10M which have the two-dimensional configuration of arbitration. Moreover, drawing 5 (b) is the elevation. Here, several n is three or more integers.
[0050] Moreover, the rectangular coordinates system XYZ which makes the point of arbitration Zero O and makes XY side the inside of a field parallel to this plate surface of control-panel 10M is defined. And the case where control-panel 10M are pressed downward for the location of Point P (x y) by Thrust F is assumed. this time -- XY coordinate value of Point P -- it is (x y) -- the principle detected by the function of piezoelectric devices E1-En is as follows. In addition, if the actuated valve position of the XY direction of control-panel 10M is got to know, since it is obvious that it is about the Z coordinate of Point P on the plate surface whose it is control-panel 10M, and it is enough, it is not necessary to ask for the Z coordinate of Point P concretely.
[0051] First, when XY coordinate of a piezoelectric device Ek (k=1-n) is set to (xk, yk), these are the known values from a design. Moreover, since an electrical potential difference will arise to the both ends if a pressure is applied by the congruence directional change function, each piezoelectric devices E1-En can know the force fk (k=1-n) which joined those piezoelectric devices E1-En by it. If these force f1-fn is seen from control-panel 10M, it will become the reaction committed upward.
[0052] From the balance of the force of the Z direction which took into consideration Thrust F and the force f1-fn which joined piezoelectric devices E1-En about control-panel 10M which have self-weight W at this time [to 0053]
[Equation 1] F+W-sigma fk=0 is materialized. However, in this formula and each following type, a summation symbol sigma shows the sum to 1-n about Subscript k.
[0054] From the balance of the moment of force of the circumference of the X-axis, and the circumference of a Y-axis [to 0055 [next,]]
[Equation 2] sigmafk-xk+F-x+W-x 0= 0 [0056]
[Equation 3] sigmafk-yk+F-y+W-y 0= 0 is materialized. However, (x0, y0) are XY coordinates of the center of gravity of control-panel 10M, and this is also known.
[0057] When several 1 and several 2 are transformed, it is [0058], respectively.
[Equation 4] x=-(sigmafk-xk+W-x0)/F [0059]
[Equation 5] Although set to y=-(sigmafk-yk+W-y0)/F, it is [0060] from several 1.
[Equation 6] Since it is F=sigma fk-W, this is substituted for several 4 and several 5, and it is [0061].
[Equation 7]
x=-(sigmafk-xk+W-x0)/(sigmafk-W)
[0062]
[Equation 8]
y=-(sigmafk-yk+W-y0)/(sigmafk-W)
****
[0063] Moreover, if the center of gravity of control-panel 10M is taken at the zero of XYZ system of

coordinates, since it will be set to x0=0 and y0=0, it is [0064].
[Equation 9] x=-(sigmafk-xk)/(sigmafk-W)
[0065]
[Equation 10] y=-(sigmafk-yk)/(sigmafk-W)
It becomes.
[0066] Moreover, for control-panel 10M, several 1 is [0067] when only the include angle theta (not shown) leans from the horizontal plane.
[Equation 11] It is set to F+W-cos theta-sigma fk=0, it responds to it, and several 9 and several 10 are [0068].
[Equation 12]
x=-(sigmafk-xk)/(sigmafk-W-COStheta)
[0069]
[Equation 13]
y=-(sigmafk-yk)/(sigmafk-W-COStheta)
It becomes.
[0070] Several 12 and several 13 (or several 7, several 8; a-nine number, several 10) are the general formulas which calculate XY coordinate (x y) of an operating point (pressing point) P from the detection value fk (k=1-n) of the force of the force in these piezoelectric devices E1-En.
[0071] It is as follows when these general formulas are materialized about the control panel 10 of this operation gestalt. That is, in the case of this operation gestalt, since it is n= 4, when the rectangular side length which specifies arrangement of piezoelectric devices E1-E4 is made into 2a and 2b, respectively as shown in drawing 6 and origin of coordinates O are taken in the main (center of gravity) location of this rectangle, it is several 12 and several 13 to [0072].
[Equation 14] x=a- {(f1+f3) - (f2+f4)} /(f1+f3+f2+f4-W-COStheta) [0073]
[Equation 15] It becomes y=b-{(f1+f2) - (f3+f4)}/(f1+f3+f2+f4-W-COStheta).
[0074] Here, when it fixes spatially and uses an information display 100 like this operation gestalt, self-weight component W-costheta of a control panel 10 can be measured or calculated beforehand, but in using for the information display of a portable mold like other examples mentioned later, theta changes variously whenever [angle-of-inclination]. In such a case, although self-weight component W-costheta becomes less fixed, also in such a case, the press actuated valve position by the operator can be pinpointed. The reason exists as follows.
[0075] ** First, only when the sum of the amounts f1-f4 of detection of the force by the above-mentioned piezoelectric devices E1-E4 is beyond a predetermined threshold, constitute a control section so that it may suppose that it is effective. If the quite bigger value as such a threshold fh than the self-weight W of a control panel 10 is set up at this time Since a peace (f1+f3+f2+f4) part becomes quite larger than the part of (-W-COStheta) among the denominators of the several 14 and several 15 right-hand side, a peace (f1+f3+f2+f4) part serves as the principal part among the denominators of the several 14 and several 15 right-hand side substantially. For this reason, it is [0076] as several 14 and several 15 approximate expression.
[Equation 16] x=a- {(f1+f3) - (f2+f4)} /(f1+f3+f2+f4) [0077]
[Equation 17] y=b- {(f1+f2) - (f3+f4)} There are few errors also as /(f1+f3+f2+f4), and it is available in these several 16 and several 17.
[0078] ** In an information display which operates a screen with a finger, so fine a precision is not needed for pinpointing of a press actuated valve position in many cases. That is, if it specifies any of the actuation fields R1-R7 are operated, or whether these neither is operated, since the example of drawing 4 is sufficient, even if some error appears in detection of an actuation press location by the self-weight component or other factors, it is fully equal to practical use. Preferably, the actuation fields R1-R7 are not arranged densely, but separate and arrange a certain amount of spacing mutually. Thereby, incorrect detection near the border line of an actuation field can be prevented.
[0079] For the above reasons, the information display of a portable mold can also apply the above-mentioned operation principle. In addition, even if it is not a portable mold, in setting up the bigger

value as a threshold fh of thrust than the self-weight W of a control panel 10, it is satisfactory for using several 9, several 10 or several 16, and several 17 as an approximate expression.
[0080] <1-3. The configuration and actuation of the control circuit section CT (drawing 7) of an information display 100 are explained being based on the configuration of the control circuit section CT, > of operation, next the above principle. In addition, although the example at the time of constituting the control circuit section CT from a hard circuit here is shown, software may realize using a microcomputer. In that case, each following circuit part is functionally realized by MPU and memory of a microcomputer.
[0081] <1-4. In thrust detection > drawing 7 by piezoelectric devices E1-E4, each terminal voltage ek (k=1-4) of the piezoelectric devices E1-E4 combined with the control panel 10 is given to operation part 51 in juxtaposition.
[0082] Drawing 8 shows the internal configuration of this operation part 51. The numerical relation of the force and terminal voltage which join piezoelectric devices E1-E4 is beforehand set as signal transformation section 51a in operation part 51. Each terminal voltage ek of piezoelectric devices E1-E4 is changed into the signal Sfk expressing the force fk (k=1-4) in which it has joined piezoelectric devices E1-E4 by this signal transformation section 51a, and these signals Sfk are given in juxtaposition to location operation part 51b and operating-physical-force detecting-element 51c.
[0083] The distance constants a and b (refer to drawing 6) which constant storage section 51c was made to memorize beforehand are also given to location operation part 51b again, and location operation part 51b computes the position coordinate (x y) of several 16 and several 17 operating point mentioned already. In addition, when using several 14 and several 15 instead of several 15 and several 16, constant storage section 51c is made to also memorize the value about a self-weight component (W-costheta), and it is also used.
[0084] On the other hand, in 51d of operating-physical-force detecting elements, total sigmafk of Force fk (k=1-4) is calculated. When also taking into consideration the self-weight of a control panel 10, further, the value of (W-costheta) from constant storage section 51c is also taken into consideration, and an operating physical force F is searched for from several 11. In addition, if the value of the operating physical force F searched for by 51d of this operating-physical-force operation part is made to use it as a value of the denominator of the operation (for example, several 16, 17) in location operation part 51b, it can be managed even if it does not calculate sum sigmafk on the both sides of location operation part and operating-physical-force operation part.
[0085] From operation part 51, the operating-physical-force signal SF which shows the actuation position signal SP which shows an actuated valve position P (x y), and an operating physical force F is outputted these results. The actuation position signal SP has two components of (x, y).
[0086] <1-5. It returns to judgment > drawing 7 of an actuated valve position (actuation field), and the actuation position signal SP acquired by operation part 51 is given to the field judging section 52. The information (xi-, xi+, yi-, yi+:i=1-7) expressing each top-most-vertices coordinate (refer to drawing 9) of the actuation fields R1-R7 of drawing 4 is inputted into this field judging section 52 from the field partition storage section 53. The information on these top-most-vertices coordinates is loaded from the information processing section 60 (drawing 7) mentioned later according to the contents of a display in the time.
[0087] The field judging section 52 judges in any an operating point P shall be about the coordinate value (x y) of an operating point P as compared with each top-most-vertices coordinate of the actuation fields R1-R7 obtained as mentioned above between these actuation fields R1-R7 and a field R0 in comparison test section 52a (drawing 10). For example, in the part concerning a field R2 among comparison test section 52a, it is [0088].
[Equation 18] x2- <= x <= x2+ and -- If the comparison operation of whether it is y2-<= y <= y2+ is carried out and this several 18 is materialized, it will be judged with the current operating point P being in the actuation field R2.
[0089] Moreover, it is judged whether the coordinate value (x y) of an operating point P is in fields R0 other than actuation field [in a liquid crystal display screen] R1 - R7 (non-operating field).

[0090] Therefore, from comparison test section 52a of drawing 10 , the actuation field R1 expressing whether either the actuation fields R1-R7 or the non-operating field R0 is directed - R6 partition signal SR are outputted. In addition, while the operator is touching neither of the actuation side 11, the actuation position signal SP is made into non-activity level, and let the field judging signal SR be non-activity level according to it. In order to distinguish two or more fields R1-R0 and non-activity level, the field judging signal SR is made into a multiple-value signal with two or more bits.
[0091] <1-6. In judgment > one side of an operating physical force, and drawing 7 , the operating-physical-force signal SF which shows an operating physical force F is given to the operating-physical-force judging section 54. Two or more thresholds Fh1-Fh4 which specify the operating-physical-force partitions F0-F4 of drawing 11 are inputted into this operating-physical-force judging section 54 from the operating-physical-force partition storage section 55. The information on these thresholds Fh1-Fh4 is also loaded from the information processing section 60 mentioned later according to the contents of a display in the time. Moreover, although four operating-physical-force partitions F0-F4 are prescribed by the example here, the number of partitions of the force can also be changed according to the contents of a display in the time.
[0092] Furthermore, the field judging signal SR from the field judging section 52 is inputted into the field partition storage section 55. And according to any they are, modification of the value of thresholds Fh1-Fh4 of the field ("it is Field R during actuation") where the actuated valve position P in the time belongs is attained. [the following,] It can follow, for example, the value of thresholds Fh1-Fh4 can be made small about the actuation fields R1-R6, and the value of thresholds Fh1-Fh4 can be enlarged about the actuation field R7. Although these correspondence relation is beforehand memorized in the table format in the information processing section 60 of drawing 7 , about the concrete modification approach of these thresholds, it mentions later.
[0093] However, in any case, press by the operating physical force F with the minimum threshold Fh1 smaller than it of the thresholds Fh1-Fh4 is a threshold for not regarding it as selection actuation of a menu, and is for tracing and making actuation possible. That is, since an operating physical force is hardly added while tracing and only moving the finger on the actuation side 11, respectively in actuation, it can trace by discriminating from an operating physical force with the minimum threshold Fh1, and inner malfunction can be prevented. Since the minimum threshold Fh1 has such semantics, about this minimum threshold Fh1, what is considered as constant value irrespective of an actuation field or the contents of a display is desirable.
[0094] When calling four operating-physical-force partitions F1-F4 of the range of the one or more minimum thresholds Fh an "effective operating-physical-force partition", the operating-physical-force judging section 54 In comparison test section 54a in it (drawing 12), it judges in any of the effective operating-physical-force partitions F1-F4 the operating physical force F in the time is by comparing, respectively in the operating-physical-force thresholds Fh1-Fh4 about the operating physical force F in the time of being directed by the operating-physical-force signal SF. For example, [0095]
[Equation 19] If it is Fh1 <= F < Fh2, it will judge with press in the effective operating-physical-force partition F1, and it is [0096].
[Equation 20] If it is Fh4 <= F, it will judge with press in the effective operating-physical-force partition F4.
[0097] Moreover, it will be [0098], if it puts in another way when there is no operating physical force F in all of the operating-physical-force partitions F1-F4.
[Equation 21] When it is F<Fh1, it judges with press ("there is no substantial press actuation") in the operating-physical-force partition F0.
[0099] And about the effective operating-physical-force partitions F1-F4, a signal which is activated when the operating physical force F in the time belongs to those partitions is generated. When one signal of the effective operating-physical-force partitions F1-F4 is also non-activity, an operating physical force F means that it is smaller than the minimum threshold Fh1.
[0100] Each signal from judgment section 54a of these effective operating-physical-force partitions F1-F4 is given to OR-circuit 54b, and the actuation valid signal FC as those OR signals is generated.

Therefore, the operating physical forces F in that time are the one or more minimum judging thresholds Fh, and when judged with the operator doing press actuation of the actuation side 11 substantially by it, this actuation valid signal FC will be activated. Conversely, if it says, when the operator is not pressing the actuation side 11 at all, or when still final selection actuation is omitted although the actuation side 11 is touched, this actuation valid signal FC will still be non-activity level (when it traces and is under actuation etc.).

[0101] Moreover, the signal from each judgment section of the effective operating-physical-force partitions F1-F4 is outputted to the drive mode selection section 72 of drawing 7 as an operating-physical-force judging signal FB. This is used as information for making the drive mode of the actuation side 11 by piezoelectric devices E1-E4 choose by in which partition an operating physical force F is.

[0102] By the way, as shown in drawing 7 , the field judging signal SR from the field judging section 52 is inputted into the operating-physical-force partition storage section 55. This is because modification of the value of thresholds Fh1-Fh4 is enabled according to Field R during actuation as mentioned already. According to the screen currently displayed at the time, from the information processing section 60, two or more groups of thresholds Fh1-Fh4 are inputted into the operating-physical-force partition storage 55, are memorized, and, specifically, choose 1 set of thresholds from the inside according to the field partition signal R. For this reason, in changing the threshold of an operating physical force F into every field R (or actuated valve position in that time) during actuation in this way, after the field judging signal SR is generated from the field judging section 52, it is made to perform an operating-physical-force judging in the operating-physical-force judging section 54. This can be attained by only very small time amount's delaying the timing of comparison test section 54a of drawing 12 of operation from the operating time of the field judging section 52, or inserting a delay circuit before this comparison test section 54a.

[0103] <1-7. In gate > drawing 7 of the field judging signal R, the field judging signal SR outputted from the field judging section 52 is outputted to the information processing section 60, a gate circuit 56, and AND circuit 57. Moreover, the actuation valid signal FC is also inputted into this AND circuit 57.

[0104] AND circuit 57 searches for the AND of the field judging signal SR and the actuation valid signal FC, and gives it to a gate circuit 56 by making the value of the AND into the gate control signal G. In a gate circuit 56, when the gate control signal G is activity (i.e., only when one part of the actuation sides 11 is operated by the bigger force than the minimum threshold Fh1), the field judging signal SR is passed.

[0105] The field judging signal SR which passed through this gate circuit 56 is inputted into the 1st processing section 61 in the information processing section 60. This 1st processing section 61 tells that to an external instrument (for example, host computer) if needed while generating the control signal to the information processing and each part of equipment according to the menu item in which the operator did selection actuation with this field judging signal SR. For example, when the "drawer" equivalent to the field R2 of drawing 3 is chosen, it switches to the alter operation screen of the drawer amount of money by driving the liquid crystal display panel 20 through a display driver 71.

[0106] The field judging signal SR which bypassed the gate circuit 56 and was inputted into the information processing section 60 on the other hand is inputted into the 2nd processing section 62 in the information processing section 60. In this 2nd processing section 62, even if substantial press actuation by the with a minimum thresholds [by the operator / Fh] of one or more force is not performed yet, one field of the actuation sides 11 is contacted by a certain amount of [an operator's finger] force, and, sometimes, predetermined processing is performed. For example, the foreground color of the field where the finger is touching at the time can be changed, and things can show ["as actuation in which field it will be regarded if a depression is carried out in the location" and] an operator. Moreover, the voice guidance "it is a "drawer" there" may be made to perform.

[0107] <1-8. Drive mode selection > On the other hand, the oscillation mode selection section 72 of drawing 7 which inputted the field judging signal SR and the operating-physical-force judging signal FB chooses a field and the drive mode according to the partition of an operating physical force F during actuation. This drive mode specifies in what kind of mode the actuation side 11 is vibrated.

[0108] As shown in drawing 13 , to any of the operating-physical-force partitions F1-F4 the partition which makes it the 1st index to any of fields R1-R0 for the field judging signal SR to specifically belong, and the operating-physical-force judging signal FB is expressing belongs as the 2nd index It is beforehand stored in table 72a which drive mode should be chosen to the combination of them 1st and the 2nd index. The notations S11 and S12 in drawing 13 and -- are the codes for choosing and specifying either of various kinds of drive modes like drawing 14 .
[0109] Drawing 14 shows typically the various drive modes memorized by the drive mode storage section 73. For example, drawing 14 (a) shows the mode in which continuous vibration is performed by small-size width of face, and drawing 14 (b) is the oscillation mode of the large amplitude. Drawing 14 (a) and (b) show the oscillation mode from which a frequency differs, and, as for drawing 14 (d) and (e), drawing 14 (c) shows 1 time or the example performed twice for vibration of single time amount, respectively. Furthermore, drawing 14 (f) is the oscillation mode which gives only one vibration (single shot pulse). In addition, the example in the modes other than this is explained later.
[0110] Such drive modes have become identifiable in predetermined parameter code, and oscillation frequency VF, an amplitude VD, the oscillating persistence time VT, etc. are those parameters in the example of drawing 14 (d).
[0111] It can return to drawing 13 and a variation can be given to the drive of the actuation side 11 by changing the contents of storage of table 72a. For example, what is necessary is just to decide the code of the range of S11-S64 to specify the oscillation mode of drawing 14 (a) to give a vibration weak about the actuation fields R1-R6. Moreover, what is necessary is to specify the oscillation mode of drawing 14 (a) in the operating-physical-force partitions F1 and F2 of drawing 13 and just to specify the oscillation mode of drawing 14 (b) in the operating-physical-force partitions F3 and F4, respectively to enlarge the strength of vibration so that an operating physical force F is large. A weak vibration may be given although it is desirable to specify "he has no drive" as for the codes S01-S04 about the non-operating field R0.
[0112] Thus, if one drive mode is chosen by the field judging signal SR and the operating-physical-force judging signal FB, the parameter value which specifies the drive mode will be read from the drive mode storage section 73 of drawing 14 , and will be given to the piezoelectric-device mechanical component 75 of drawing 7 . While an oscillating electrical potential difference is given to piezoelectric devices E1-E4 according to it and piezoelectric devices E1-E4 vibrate or deform [very small], the vibration or very small displacement spreads to the actuation side 11. This produces operation of telling an operator about the actuation having been received vibration or by making it sliding very small in the actuation side 11 tactile, when an operator pushes either of the actuation fields R1-R7 by the force more than predetermined.
[0113] By the way, there is no train which specifies drive mode about the case where an operating physical force F is the one or less minimum threshold Fh in table 72a of drawing 13 . This does not make the actuation side 11 drive in such a case, but originates in so it not being necessary to choose drive mode.
[0114] When the operating-physical-force judging signal FB is activity, the parameter signal V in the drive mode specified in the correspondence part of table 72a is outputted to the piezoelectric-device mechanical component 75 of drawing 7 by such configuration, but when the operating-physical-force judging signal FB is non-activity, the information on any drive mode is not outputted to the piezoelectric-device mechanical component 75, either. For this reason, only when the with a minimum thresholds [Fh] of one or more operating physical force F joins the actuation side 11, the actuation side 11 comes to vibrate or very small displace.
[0115] In addition, when not changing in the magnitude of an operating physical force F about the non-operating field R0 but having set up, saying "he has no vibration", if it is the non-operating field R0 even if the with a minimum thresholds [Fh] of one or more operating physical force F joins the actuation side 11, vibration etc. will not take place.
[0116] Moreover, in the example of drawing 13 and drawing 14 , the selection rule from it are prepared in the table format, and various kinds of oscillation modes may also hold these selection rule as a

function which made the actuation field judging signal SR and the operating-physical-force judging signal FB two input variables.

[0117] By the way, in these drive mode selection actuation, only when the with a minimum thresholds [Fh] of one or more operating physical force F joins the actuation side 11, in order to make piezoelectric devices E1-E4 drive, other configurations can also be taken. That is, it is made to input into gate circuit 72b which added and established the AND signal G which is the output of AND circuit 57 in the drive mode selection section 72 of drawing 13 as a gate control signal, as the broken line 74 showed to drawing 7 and drawing 13 . This gate circuit 72b controls transfer in the drive mode storage section 73 of the selection output from table 72a, or transfer of the parameter signal V in the drive mode to the drive mode storage section 73. That is, if an operating physical force F is smaller than the minimum threshold Fh1, since the AND signal G is surely non-activity, it can forbid transfer in drive mode using this. Table 72a is specified only about the field judging signal SR, and such deformation is effective especially when constituted as equipment to which drive mode is not changed depending on the magnitude of an operating physical force F.

[0118] That is, in such a case, it is a problem whether it is larger than the minimum threshold Fh1, and to which operating-physical-force sections F1-F4 it belongs in beyond it does not need to judge an operating physical force F. For this reason, it is not necessary to generate the operating-physical-force judging signal FB, and transfer of the operating-physical-force judging signal FB from this operating-physical-force judging section 54 to the drive mode selection section 72 can also be omitted in the operating-physical-force judging section 54 of drawing 7 . For this reason, only when larger than the minimum threshold Fh1, in order for an operating physical force F to make generating of vibration of the actuation side 11 permit in such a case, additional gate circuit 72b is used and the utility using the AND signal G which is the output of AND circuit 57 becomes high.

[0119] Furthermore, it is more desirable to rewrite table 72a of drawing 13 for every screen displayed on the liquid crystal display panel 20. That is, when the contents currently displayed on the liquid crystal display panel 20 change, various kinds of drive modes of the actuation side 11 can be colorfully used by changing the drive mode to choose for every actuation field in the new contents of a display for every operating-physical-force section to which an operating physical force F belongs again. for example, -- although an actuation field turns into a field which imitated the ten key when the menu item of a "drawer" is chosen and pulled out and it changes into the input screen of the amount of money -- them -- if -- a depression is carried out -- ** -- alike -- single shot like drawing 14 (f) for example, -- you may make it give a variation rate In such single shot displacement, the so-called feeling of a click can be given to an operator.

[0120] Thus, whenever a screen switches, in order to rewrite the contents of table 72a, table rewriting information is inputted into the drive mode selection section 72 from the information processing section 60. That is, synchronizing with the screen currently displayed on the liquid crystal display panel 20 changing, the information processing section 60 of drawing 7 will load the new contents of drive mode select table 72b to the threshold group which specifies a new operating-physical-force partition for the coordinate value which specifies a new actuation field to ** actuation field partition storage section 53 to ** operating-physical-force partition storage section 55, and ** drive mode selection section 72, respectively.

[0121] <1-9. In drive control > drawing 7 , the parameter signal V in the drive mode outputted from the drive mode selection section 72 is given to the piezoelectric-device mechanical component 75. The piezoelectric-device mechanical component 75 has the RF oscillator circuit 76, and sends out the RF in the mode specified by the parameter signal V to piezoelectric devices E1-E4. By this, piezoelectric devices E1-E4 are vibrated or very small displaced to the amplitude and timing which were specified.

[0122] This dynamic reaction is spread to the control panel 10 of drawing 3 , and the actuation side 11 carries out vibration or very small displacement by it. And it recognizes that this vibration has been perceived by the operator in contact with the actuation side 11, and the actuation input of self was normally received.

[0123] By the way, in drawing 7 , piezoelectric devices E1-E4 are connected to the both sides of

operation part 51 and the piezoelectric-device mechanical component 75 with predetermined wiring. Therefore, if a RF is outputted from the piezoelectric-device mechanical component 75, the RF will be transmitted also to operation part 51. In order to separate the electrical potential difference generated according to the operating physical force to piezoelectric devices E1-E4, and this RF, a low-pass filter can be prepared into signal transformation section 51a of drawing 8 . If it is made such, the RF of vibration can be cut with this low-pass filter, can take out only the dc component by the operating physical force, and can use it for the operation of an actuated valve position P and an operating physical force F. Moreover, interference of such a signal can also be prevented by making the minimum threshold Fh1 about an operating physical force F larger than the amplitude of the driving signal of piezoelectric devices E1-E4.

[0124] In being the information display from which an operator's actuation input is answered and a screen changes, it stops vibration, after only predetermined time amount vibrates a control panel 10. This can be attained using the signal transduction path from the information processing section 60 to the drive mode selection section 74 of drawing 7 by making the parameter signal V in drive mode into non-activity level compulsorily. Moreover, operation part 51 and the piezoelectric-device mechanical component 75 may be unified, and incorporation of the signal from piezoelectric devices E1-E4 and sending out of the high frequency to piezoelectric devices E1-E4 may be switched in time using a switching circuit. Furthermore, the oscillation mode of a short time as shown in drawing 14 (d) and (e) may be chosen.

[0125] Drawing 14 (a) As long as the operator is applying the larger operating physical force F than the minimum threshold Fh1 in the case of the oscillation mode like - (c), vibration continues. If an operator weakens an operating physical force F or lifts a finger from the actuation side 11, it will be detected by the operating-physical-force judging section 54, and the operating-physical-force judging signal FB to the drive mode selection section 72 will become non-activity. Consequently, the parameter signal V in drive mode is set to non-activity level, and vibration of the actuation side 11 stops.

[0126] <1-10. main advantage > of an information display 100 -- as mentioned above, since it is used also in order to detect the field chosen by the operator in the piezoelectric devices E1-E4 for giving an operator tactile feeling by actuation, it is not necessary to prepare many components separately per these with the information display 100 of this operation gestalt

[0127] Therefore, an effective feeling of actuation can be given, specifying which actuation field was operated, without increasing the components mark of the actuation side 11 and information-display side 21 neighborhood.

[0128] Since this feeling of actuation uses a tactile sense, when the surrounding noise is loud, or even when dark in a perimeter, it can obtain a clear feeling of actuation. Moreover, consciousness is possible not only to a hearing-impaired person but people with visual disturbance, such as dysopsia.

[0129] Furthermore, in order not to consider that press by the operating physical force F smaller than the minimum threshold Fh1 is effective actuation, it is traced and can be operated.

[0130] Furthermore, since modification of the drive mode given to the actuation side 11 by the difference in an operating physical force or an actuation field is attained, a variegated feeling of actuation can be given to an operator.

[0131] Moreover, since the minimum threshold Fh1 of an operating physical force F can be changed, about the actuation field (for example, actuation fields, such as an official-in-charge call and an emergency report) I want you to choose carefully, derangement by the false drop can be prevented by setting up the minimum threshold Fh1 more greatly rather than other actuation fields.

[0132] <2. 2nd operation gestalt > drawing 15 shows the part equivalent to the display control unit DP of the information display which is the 2nd operation gestalt of this invention -- it is an abbreviation sectional view a part, and it is used, permuting by the structure of drawing 3 . The informational example of a use mode and informational appearance of this 2nd operation gestalt are the same as that of drawing 1 and drawing 2 .

[0133] In drawing 15 , the display control unit DP of this 2nd operation gestalt pinpoints the actuated valve position by the operator by touch panel 10T. These touch panel 10T are the thing of for example, a

resistance film type, and have the transparent electrode arranged in the shape of [of a M-line N train] a direct matrix in XY side on a transparence substrate. Each of those intersections serve as the switch section, and the actuation position signal of the XY direction is outputted by making each cel of a matrix into a unit.

[0134] These touch panel 10T are not only the thing of a resistance film type but (1). Photoelectrical-type touch panel which is made to intercept or decrease with a finger etc. that data light carries out incidence to a photo detector from a light emitting device, and detects that actuated valve position, (2) The ultrasonic-type touch panel which is made to intercept or decrease with a finger etc. that the supersonic wave which came out of the ultrasonic oscillation component goes into a vibration receiving element, and detects the actuated valve position, and (3) You may be the electrostatic-capacity-type touch panel which detects the location where the finger etc. touched by change of electrostatic capacity.

[0135] The touch panel support plate 42 may be a thing for reinforcement of touch panel 10T, and when making the part corresponding to touch panel 10T into a ********** frame configuration like the example of illustration, it may be an opaque member. When making it plate-like, without making it a frame configuration, forming by transparence or the translucent member is desirable. Moreover, when it has the reinforcement of extent which touch panel 10T self pushes in and does not deform by actuation, either, it is not necessary to form this touch panel support plate 42.

[0136] Although the configuration of the remainder of the display control unit DP of drawing 15 is the same as that of the thing of drawing 3 , in the display control unit DP of this drawing 15 , touch panel 10T perform detection of an actuated valve position, and piezoelectric devices E1-E4 are used for the purpose of detection of the operating physical force to the actuation side 11, and the dynamic drive to the actuation side 11.

[0137] Drawing 16 can also realize those functions in software, although it is the block diagram of the control circuit section CT in the case of using the display control unit DP of drawing 15 and is indicated as a hard circuit like drawing 7 . Many elements of the control circuit section CT of this drawing 16 have the same configuration and same function as a case of drawing 7 , and below, they explain a different part from drawing 7 , comparing drawing 16 with drawing 7 .

[0138] In drawing 16 , the actuated valve position of touch panel 10T is pinpointed by actuated-valve-position specification section 51T. However, since touch panel 10T are the matrix array of a M line N train, the actuation position signal SP which shows this actuated valve position serves as a value which made the unit size of each cel of touch panel 10T.

[0139] Although judged by the field judging section 52, the configuration and actuation of this field judging section 52 of whether this actuation position signal SP is equivalent to any of the actuation fields R1-R7 are fundamentally [as the thing of drawing 7] the same.

[0140] On the other hand, although each terminal voltage ek (k=1-4) of piezoelectric devices E1-E4 is given to operation part 51F in juxtaposition, these operation part 51F are equivalent to what omitted location operation part 51b from the configuration of drawing 8 . Namely, what is necessary is for from the output voltage of piezoelectric devices E1-E4 just to calculate the total operating physical force F, since pinpointing of the actuated valve position in this 2nd operation gestalt performs using touch panel 10T.

[0141] The operating-physical-force signal SF which is the output of operation part 51F is outputted to the operating-physical-force judging section 54, and it is judged to any of which operating-physical-force partitions F0-F4 (drawing 11) the operating physical force F belongs.

[0142] Future configurations and actuation are the same as that of the 1st operation gestalt. With this 2nd operation gestalt, there is an advantage that there are especially few errors in detection of an actuated valve position besides the advantage in the equipment of the 1st operation gestalt. That is, when it pinpoints an actuated valve position with the terminal voltage ek (k=1-4) of piezoelectric devices E1-E4, as mentioned already, it has the influence of the self-weight of a control panel 10 etc. Although this error hardly becomes a problem when comparatively large each of the actuation fields R1-R7 is taken, more exact actuated-valve-position detection is called for to make each area of an actuation field small especially. In such a case, it is desirable to use touch panel 10T like the 2nd operation gestalt.

[0143] Moreover, if touch panel 10T are used, since the location operation from terminal voltage ek (k=1-4) will become unnecessary, there is also an advantage that an actuation field can be pinpointed at high speed.
[0144] <3. 3rd operation gestalt > drawing 17 is the appearance perspective view of the information display 200 concerning the 3rd operation gestalt of this invention, and drawing 18 is that front view. This information display 200 serves as a game machine of the liquid crystal display mold as one example of the information display of a portable mold. The actuation side 11 has exposed this information display 200 to the principal plane MS of the housing 201 of a cube type. This actuation side is equivalent to the control panel 10 of drawing 3 , or the front face of touch panel 10T of drawing 15 . A back display control unit and the back control circuit section consist of this actuation side 11 like the display control unit DP of the 1st operation gestalt or the 2nd operation gestalt.
[0145] The actuation fields R1-R4 displayed by the liquid crystal display panel penetrate in the actuation side 11 of drawing 17 , and it is visible to it. These actuation fields R1-R4 are typically displayed along with the both-sides section. To drawing 17 , an operator grasps the both sides of housing 201 with both hands, as a broken line shows, and he presses and operates these actuation fields R1-R4 with the thumb. If it is bigger thrust than a predetermined threshold while the location of this press actuation is detected, while that actuation input will be received and the display object 210 (drawing 18) in a screen will change, the actuation side 11 vibrates or displaces [very small] in the predetermined mode. Actuation of this hit is the same as that of the 1st and 2nd operation gestalt.
[0146] On the other hand, in this information display 200, the fixed manual operation button 203 is formed in the side face of housing 201. Moreover, as shown in drawing 19 as rear view, the cell case covering 224 is avoided also at the rear face 220 of housing 201, and the fixed manual operation button 221,222 and the cross-joint manual operation button 223 are arranged. These fixed carbon buttons 203,221-223 can be assigned to migration, actuation, etc. of initiation/termination of a game, the change of the contents of a display of a screen, and the object in a screen. Typically, these fixed carbon buttons 203,221-223 are operated with fingers other than the thumb among the fingers which grasped housing 201.
[0147] With this conventional kind of equipment, while the liquid crystal display screen had the function of only a display, since the fixed carbon button was arranged at the principal plane MS, the area of a liquid crystal display side was narrow. However, in the information display 200 of this operation gestalt, since the actuation input is possible also in respect of [11] the actuation on a liquid crystal display screen, much area of a principal plane MS can be used as a display actuation side by moving a fixed carbon button to fields other than the principal plane of housing 201.
[0148] Furthermore, although only the fixed carbon button was prepared with conventional equipment, since the contents of a display and the location of the actuation fields R1-R4 are adjustable in the equipment of this operation gestalt, a variegated actuation input is attained according to various situations.
[0149] In addition, as shown in drawing 17 , there is an electric power switch 202 in the head-lining side of housing 201, and such an electric power switch 202 and the voice volume adjustment dial are arranged also with conventional equipment in fields other than a principal plane MS. However, an electric power switch differs in a property from a voice volume adjustment dial in that the fixed carbon buttons 203,221-223 in the equipment of this operation gestalt are the actuation switches for receiving the actuation according to the contents of a display of an information-display side. If it says in the example of a game machine, these fixed carbon buttons 203,221-223 will be carbon buttons relevant to the contents of a game.
[0150] When this invention is applied to the information-display terminal (the so-called mobile computing devices) of such a game machine or a pocket mold, it not only gives a feeling of actuation by vibration of the actuation side 11, but it can raise presence, such as a game. That is, vibration can also be given to the actuation side 11 according to a motion of the display object on a screen (for example, KYAYARAKUTA), and the actuation side 11 can also be vibrated synchronizing with voice.
[0151] Moreover, it will also be possible to give vibration like a thing which is different in the phase of

the RF given to piezoelectric devices E1-E4, then the progressive wave which progresses towards the other end from the end of the actuation side 11, and interest, such as a game, will increase further by it.
[0152] <4. Other operation gestalt > drawing 20 is drawings showing other examples available as an information display of this invention, and shows a part of actuation side 11 which lapped the information-display side 21 and on it. The volume-control tongue part of audio equipment is displayed on a liquid crystal display panel, and it consists of this example so that it may be made to operate it with an operator's finger. If a finger 303 is moved in the direction of "H" or "L" along volume adjustment Rhine 302, displaying the slide mold volume tongue 301 for every compass, placing a finger 303 on it, and specifically applying thrust, actual sound volume will change the display of this volume tongue 301 moving along with it. It tells an operator that it is under actuation when the actuation side 11 vibrates with it.
[0153] Moreover, the amplitude changes with the locations of the volume tongue 301 currently operated at the time. For example, when the volume tongue 301 is within Section YL, it is within Section YM by small-size width of face and it is within Section YH with the inside amplitude, the actuation side 11 is vibrated with the large amplitude. By this, an operator can get tactile feeling according to the present sound volume. Moreover, according to the Y coordinate of the volume tongue 301, the amplitude can be increased continuously.
[0154] Drawing 22 shows the example of a concrete configuration for realizing such a function. This drawing 22 shows parts for some variant part of drawing 7 of the 1st operation gestalt, or drawing 16 of the 2nd operation gestalt, and the information yD which shows to any of Sections YL, YM, and YH Y coordinate on display belongs about the volume tongue 301 under actuation in that time is transmitted to the drive mode selection section 72 from the information processing section 60. Relation as which table 72a in this drive mode selection section 72 chooses drive mode according to this Y coordinate discernment value yD is memorized in the table format, and if the Y coordinate discernment value yD is large and the oscillation mode of the large amplitude is small, the oscillation mode of small-size width of face will be chosen from the drive mode storage section 73. Each oscillation mode of the large amplitude, the inside amplitude, and small-size width of face is memorized by the drive mode storage section 73.
[0155] Moreover, when the amplitude wants to change continuously, it gives the drive mode selection section 72 about the volume tongue 301 by making the value of Y coordinate on display itself into the Y coordinate identification information yD, and you may make it decide an amplitude using the increasing function of this Y coordinate identification information yD.
[0156] In any case, tongue actuation of being full of presence is realizable.
[0157] Drawing 21 is drawing showing the example of use similar to drawing 20 . The finger 303 has come to be able to carry out press actuation of push button display 304L by the side of the amount of bass, and push button display 304H by the side of the amount of loud sounds in the example of this drawing 21 . For example, if press actuation of push button display 304H by the side of the amount of loud sounds is carried out, while the slide display 305 will move along volume adjustment Rhine 302 and sound volume will become large, the amplitude of the actuation side 11 also increases. In this case, the information which shows to any of Sections YL, YM, and YH the Y coordinate of the slide display 301 per volume tongue 303 under actuation in that time itself or its Y coordinate belongs as information yD on drawing 22 is used.
[0158] Other configurations and actuation are the same as that of the equipment of the 1st operation gestalt or the 2nd operation gestalt.
[0159] <5. Modification ><5-1. bidirectional functional means > -- as a bidirectional functional means to use by this invention, or the unit functional means as that component -- ** piezoelectric device and ** -- electromagnetism -- various things, such as combination of a solenoid and a plunger and combination of ** electromagnet and a permanent magnet, are usable. In what uses an electromagnetic operation like ** or ** among these, the thrust to an actuation side produces change of magnetic-flux distribution, and carries out induction of the electrical potential difference between the terminals of a coil. And the magnitude of thrust can be judged by amplifying the electrical potential difference. namely, these -- a

displacement sensor and electromagnetism -- it uses having the function of both sides with a driving means.

[0160] When using a piezoelectric device, a piezo-electric film besides the piezoelectric device of a ceramic system etc. may be used. Drawing 23 is the partial diagrammatic view showing the example using the piezo-electric film 310. In this example, the piezo-electric film 310 is arranged under a control panel 10 or near the four corners of touch panel 10T, and these piezo-electric films 310 are supported with the elastic bodies 311, such as a spring and rubber. The display of a screen is performed by the liquid crystal display panel (not shown) arranged a control panel 10 or under touch panel 10T like each operation gestalt mentioned already. If an operator presses a control panel 10 or the part of a request of touch panel 10T, an electrical potential difference both arises on each front reverse side of the piezo-electric film 310, and thrust and a press location can be detected by [whose elastic body 311 contracts according to the thrust and a press location] detecting it.

[0161] <5-2. Extended > drawing 24 to an actuation input unit is the sectional view showing the switch as an example of the actuation input unit which realized radical Motohara ** of this invention most simply. This switch has arranged the piezoelectric device ES at the pars basilaris ossis occipitalis of a case 321, and arranges the inprinting plate 322, transparence, or the translucent actuation plate 323 on it. The top face of the actuation plate 323 turns into the actuation side 324.

[0162] Wiring 327 is extended from the piezoelectric device ES, and this wiring 327 is connected to the press detecting element 325 and the mechanical component 326. By detecting the terminal voltage of a piezoelectric device ES through a low-pass filter etc., the press detecting element 325 detects press of the actuation side 234 by the operator. this press detection section 325 sends out a switching signal to an external instrument, when the terminal voltage of a piezoelectric device ES is larger than a predetermined threshold -- sending out a detection command signal to both the piezoelectric-device mechanical components 326, by it, the piezoelectric-device mechanical component 326 generates the RF of a predetermined oscillating pattern, sends it out to a piezoelectric device ES, and vibrates a piezoelectric device ES. The actuation side 324 vibrates through the inprinting plate 322 by that cause, and tactile feeling which directs the purport by which the actuation input was received by the operator is given.

[0163] Thus, it can realize only by the piezoelectric device ES of one **, or the one-set piezoelectric device, without preparing another means for detection of press actuation, and grant of the vibration to an actuation side also about a switch without the adjustable screen, if the principle of this invention is followed.

[0164] There may not be the inprinting plate 322 in the switch of drawing 24 . In this case, a fixed display may be performed on the front face of actuation plate 324 self, and you may display out of this switch. That is, this invention is extensible also to the actuation input unit in which itself does not have the screen.

[0165] <6. other modification > -- the following deformation is also possible in addition to each configuration explained as the operation gestalt and modification of this invention.

[0166] When two or more unit functional means (piezoelectric device etc.) detect the actuated valve position of a control panel like the 1st operation gestalt, it is desirable to distribute three or more unit functional means two-dimensional. That is because the actuated valve position in a two-dimensional field can be pinpointed correctly by detecting thrust by three or more points.

[0167] If a piezoelectric device is arranged to each of two sides which will counter if only usage depending on which the location of an actuation field is located in a line in one dimension is carried out on the other hand, an actuated valve position can be pinpointed in one dimension. therefore -- typical -- three or more points -- desirable -- a rectangular control panel -- although it is and a unit functional means is arranged in four points or the location beyond it -- the configuration of a control panel etc., and the voice of use -- it can respond like and the number of unit functional means can be fluctuated.

[0168] As the mode in which a dynamic reaction is given to an actuation side ** Hold this, while carrying out the horizontal slide of the ** control panel which carries out the horizontal slide only of the one shot of the control panels suddenly and pushing the actuation side 11. ** Hold this, while lowering

suddenly ** control panel which lowers only one shot of control panels and pushing the actuation side 11. ** While raising suddenly ** control panel which raises only one shot of control panels (drawing 14 (f) and equivalence) and pushing the actuation side 11, there is holding this etc., and the drive mode storage section 73 of drawing 14 can be made to memorize these.

[0169] In detecting the terminal voltage ek (direct current) which ** produces in piezoelectric devices E1-E4 when they press the actuation side 11, since **, **, and ** are direct-current-driving signals, if **, **, and ** generate a pulse-driving signal, it is necessary to prevent gathering a driving signal among these. among these, the case of the above-mentioned ** and ** -- the variation rate of a piezoelectric device -- the variation rate according [a direction] to an operating physical force -- since it differs from a direction (from an actuation side to facing down), if wiring is also made into another thing while making into a different location the terminal location which gives a driving signal, and the terminal location which takes out Signal ek, the driving signal of a piezoelectric device and the terminal voltage by the operating physical force are mutually separable.

[0170] On the other hand, in **, since the electrical potential difference by the driving signal and the terminal voltage by the operating physical force appear in the part where a piezoelectric device is the same, it is necessary to distinguish them mutually. This is solvable from the value of direct-current-driver voltage by setting up greatly the minimum threshold Fh1 over an operating physical force.

[0171] In this invention, other members may be inserted between a control panel 10, or touch panel 10T and piezoelectric devices E1-E4. That is, it does not ask whether association with a control unit and a congruence directional change functional means is direct or indirect.

[0172] As an adjustable information-display means, combination with the emitter and reflecting plate which illuminate not only a liquid crystal display panel but EL (electroluminescent) display, a plasma display, a thin shape CRT, an LED array and a liquid crystal shutter, and it etc. can also be used.

[0173] Also when using a fixed display means, not an inprinting plate but paper and a sheet may be stuck.

[0174] When carrying out this invention as an actuation input unit without an information-display side, two or more unit functional means may be distributed two-dimensional like the 1st operation gestalt, and the function in which an actuated valve position is detected based on each output from them may be given. Such an actuation input unit can be used as a slide pad which is one sort of the pointing device of for example, a pocket mold personal computer (the so-called notebook sized personal computer). Since a motion of the finger on the actuation side in such a case can be checked by looking as a motion of the cursor on screens, such as a liquid crystal display of a personal computer, the actuation input unit itself does not need to have a display function.

[0175] Moreover, in such a case, the multi-statement of the threshold of an operating physical force is carried out, and, in the case of the operating physical force of the minimum threshold - maximum threshold within the limits, it incorporates as a migration command of cursor, and, in the case of the operating physical force beyond the maximum threshold, can incorporate as the same actuation as the click of a mouse. Also when it is not necessary to prepare the carbon button for a click separately on the body of a notebook sized personal computer and, and doing in this way and the carbon button for a click is prepared separately, click actuation can also be easily performed only with a slide pad.

[0176] Furthermore, as the functional means in the case of using this invention only for detection of the existence of actuation, and a unit functional means in the case of applying only to detection of an actuated valve position, it is also possible to use electrical conductive gum, a load cell, etc.

[0177]

[Effect of the Invention] As explained above, while the operating physical force applied to the actuation side by using a bidirectional functional means convertible in both directions in the dynamic operation and the electrical signal is detectable according to invention of claim 1 - claim 12, by answering an actuation signal and giving an electric driving signal to a bidirectional functional means, an actuation side can operate dynamically and a feeling of actuation can be given to an operator.

[0178] For this reason, even if an actuation means does not have a substantial pushing stroke, a positive feeling of actuation can be given. It is tactile, and since neither vision nor an acoustic sense is used,

when the noise is in a perimeter, or even when dark in a perimeter, consciousness is possible for this feeling of actuation. Also in a visually impaired person or a hearing-impaired person, consciousness of the dynamic reaction of an actuation side is clearly possible. [0179] Moreover, since detection of an operating physical force and a dynamics operation of an actuation side are realizable with one means, it becomes the simple information display which decreased the components mark of a near [an information-display side or an actuation side].

[0180] Since he is trying to give a driving signal to a bidirectional functional means according to invention of claim 2 when an actuation signal exceeds a predetermined threshold, only by very small thrust, it does not generate, a driving signal is traced, and it does not show the reaction which the equipment side mistook until actuation becomes possible and actually performs press actuation in the target actuation field.

[0181] According to invention of claim 3, since the mode of a driving signal is changed according to the magnitude of an actuation signal, a feeling of actuation can be made variegated.

[0182] According to invention of claim 4, it is possible to generate the position signal which expressed the actuated valve position on an actuation side with two or more unit functional means to constitute a bidirectional functional means, and since the actuated valve position on an actuation side is pinpointed, it is not necessary to add other means.

[0183] According to invention of claim 5, the actuated valve position on a superficial actuation side is detectable with three or more unit functional means.

[0184] Especially, according to invention of claim 6, the use range can use the actuation side of a large rectangle, and the actuated valve position on the actuation side can be detected.

[0185] According to invention of claim 7, since an actuated valve position is pinpointed with a touch panel, a specific precision of an actuated valve position is high, and the time amount which location specification takes is also short.

[0186] According to invention of claim 8, since the threshold of an operating physical force is changed by the actuated valve position, sensibility can be changed according to the location which carried out press actuation, and a feeling of actuation can be made variegated.

[0187] According to invention of claim 9, since the mode of a driving signal is changed by the actuated valve position, a feeling of actuation can be too made variegated.

[0188] When an operating physical force exceeds a predetermined threshold, in order to confirm a position signal substantially according to invention of claim 10, it traces and an incorrect input is not made by actuation.

[0189] Since the functional means for giving detection of an operating physical force and the dynamic operation to an actuation side is constituted from a piezoelectric device according to invention of claim 11, while being easy to miniaturize equipment, it is highly precise and detection of an operating physical force is attained.

[0190] Since according to invention of claim 12 the above-mentioned information display is held in housing and it is considering as the portable mold, sufficient feeling of actuation can be given using an information-display side effectively.

[0191] Since 1 which receives the actuation according to the contents of a display of an information-display side in the information display of a portable mold, or two or more actuation switches are formed in fields other than the principal plane of housing according to invention of claim 13, many parts of the principal plane of housing can be used for the actuation side which lapped with an information-display side and it.

[0192] And various actuation inputs are attained in accordance with actuation switches other than a principal plane, using the principal plane of housing effectively also in the actuation side, since the actuation input is possible.

[0193] According to invention of claim 14, since an actuated valve position is pinpointed with each output signal of two or more unit functional means, an actuated valve position can be pinpointed, without using a touch panel. Although a touch panel may malfunction with surface dirt etc., in order to change thrust into an electrical signal in this invention, there is also little fear of such malfunction.

[0194] While according to invention of claim 15 extending radical Motohara ** of the above-mentioned invention, constituting the actuation input unit and obtaining a feeling of actuation having no stroke and positive, components mark also serve as few actuation input units.
[0195] Furthermore, invention of claim 16 unites and has the advantage of invention of claim 14, and the advantage of invention of claim 15.

[Translation done.]